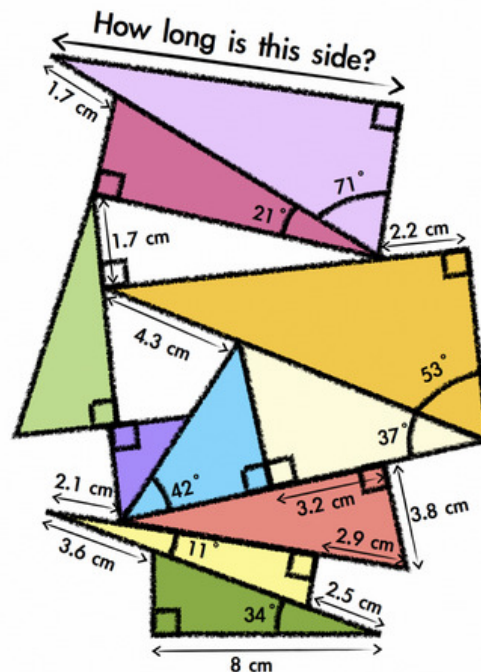


APPLICATIONS OF TRIGONOMETRY

GENERAL MATHS - HSC

Trigonometry Pile Up!







































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NAME: _____

HSC CAPACITY MATRIX - GENERAL MATHEMATICS

TOPIC: Measurement 6 - Applications of Trigonometry

2.5 weeks

CONTENT	CAPACITY BREAKDOWN!	DONE IT!!!!	GOT IT!!!!	ON MY WAY!	WORKING ON IT!	HELP!!!!
1. Review of right trigonometry, including multiple right triangles	Ex 3A Q1 & 2 LHS, 3-14					
2. Using compass bearings (8 point)	Ex 3B Q1-3, 11, 12,13, 16, 17, 18, 19					
3. True bearings	Ex 3B Q4-10, 14, 15, 20					
4. Determining the sign for above ratios for obtuse angles	Investigation					
5. Using the sine rule	Side lengths: Ex 3C LHS Angles: Ex 3D LHS					
6. Calculating area	Ex 3E LHS					
7. Cosine rule	Side lengths: Ex 3F LHS Angles: Ex 3H LHS					
8. Solving problems involving non right triangles and Pythagoras	Mixed examples (in this booklet)					
9. Conducting radial surveys	Field task Ex 3H LHS					

Your say!

What was the most important thing you learned? _____

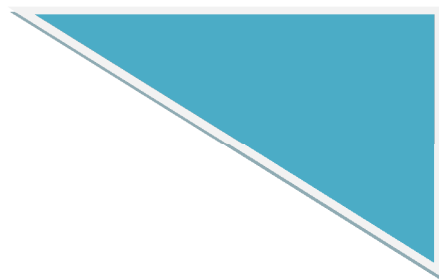
What was something new you learnt? _____

What part(s) of this topic will you need to work on? _____

REVIEW OF TRIG...

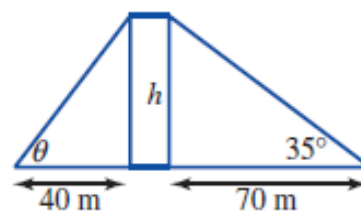


ANGLES OF ELEVATION & DEPRESSION



Greg stands 70 m from the base of a building and measures the angle of elevation to the top of the building as being 35° . Julie is standing 40 m from the base of the building on the other side of the building as shown in the figure on the right.

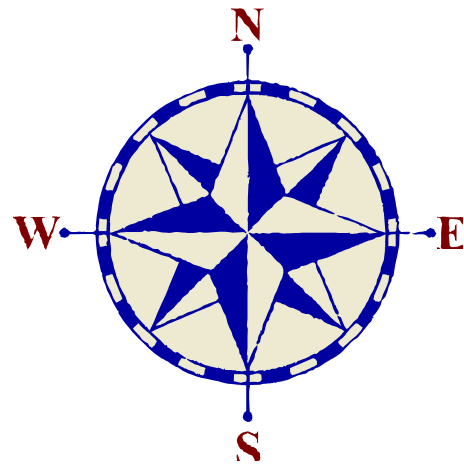
- a Calculate the height of the building, correct to 2 decimal places.
- b Calculate the angle of elevation of the top of the building that Julie would measure, correct to the nearest degree.



BEARINGS

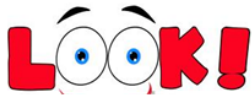
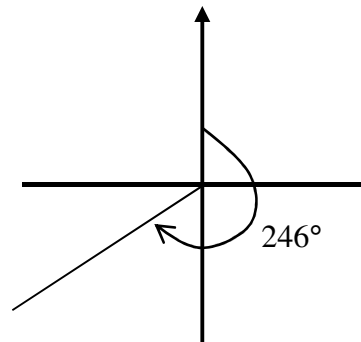
COMPASS BEARINGS:

Compass bearings are stated using the eight point compass rose.



TRUE BEARINGS:

True bearings are measured as an angle of turn. The convention is that the direction of travel is measured by a clockwise rotation from the North direction. The angles are always written using 3 digits.



What ever
the location
is "from" is
the centre of
the compass.

eg If the bearing of A from O is 110° T, what is the bearing of O from A?

[illegible]

eg A ship sails for 25 km in a SW direction from Port A. Find the distance the ship is South from its starting point.

eg A ship sails 43 km from a port X on a bearing of 326°T . Calculate how far the ship is west of port X.

eg A town is 46 km East and 73km South of a town B. Calculate the bearing of A from B.

eg Soldiers on a reconnaissance set off on a return journey from their base camp. The journey consists of three legs. The first leg is on a bearing of 150°T for 3 km; the second is on a bearing of 220°T for 5 km.

Find the direction (to the nearest minute) and distance (correct to 2 decimal places) of the third leg by which the group returns to its base camp.

OBTUSE ANGLES INVESTIGATION...

Many non-right-angled triangles have one obtuse angle. In the following sections we will be solving non-right-angled triangles and will need to investigate the trigonometric ratios for obtuse angles.

1 Use your calculator to give each of the following, correct to 3 decimal places.

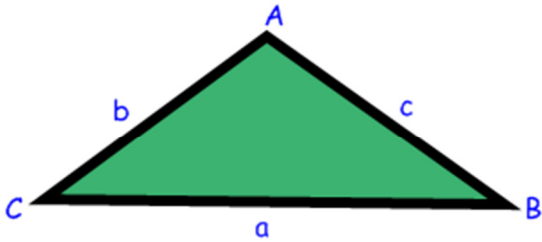
- | | | |
|---------------------------|---------------------------|---------------------------|
| a $\sin 100^\circ$ | b $\cos 100^\circ$ | c $\tan 100^\circ$ |
| d $\sin 135^\circ$ | e $\cos 135^\circ$ | f $\tan 135^\circ$ |
| g $\sin 179^\circ$ | h $\cos 179^\circ$ | i $\tan 179^\circ$ |

2 Which of the answers to question **1** are positive and which are negative?

3 Calculate the sine, cosine and tangent of several other obtuse angles and see if the established pattern continues.

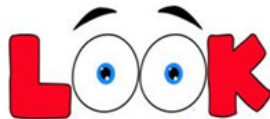
4 Can you develop a rule for the sign of trigonometric ratios of obtuse angles?

APPLYING THE SINE RULE



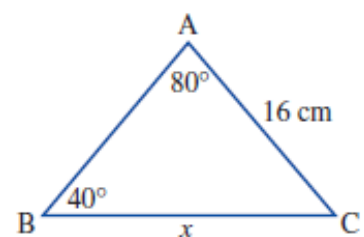
$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ *for sides;*
 You need two angles - one must be opp the side you want and the other must have its corresponding side.

$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$ *for angles;*
 You need two sides - one must be opp the angle you want and the other must have its corresponding angle.

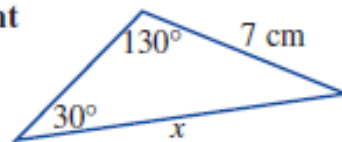


1. Highlight the important information in the question;
2. Draw a diagram and add all relevant information;
3. Select the most appropriate formula;
4. Substitute into the formula and solve;
5. CHECK you have answered the question completely.

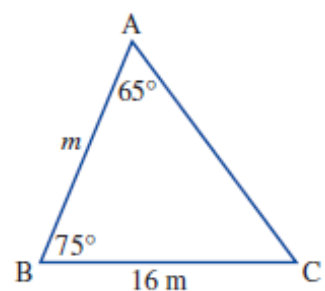
Calculate the length of the side marked x in the triangle on the right, correct to 1 decimal place.



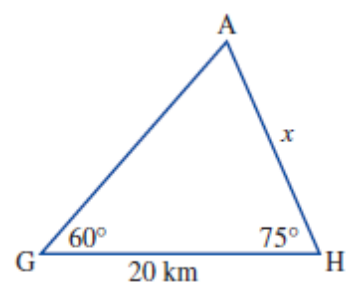
Find the unknown length, x cm, in the triangle at right (to 1 decimal place).



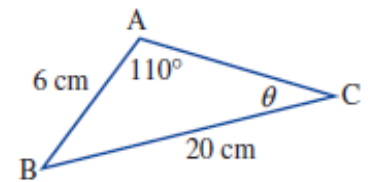
Calculate the length of the side labelled m in the figure on the right, correct to 4 significant figures.



Georg looks south and observes an aeroplane at an angle of elevation of 60° . Henrietta is 20 km south of where Georg is and she faces north to see the aeroplane at an angle of elevation of 75° . Calculate the distance of the aeroplane from Henrietta's observation point, to the nearest metre.

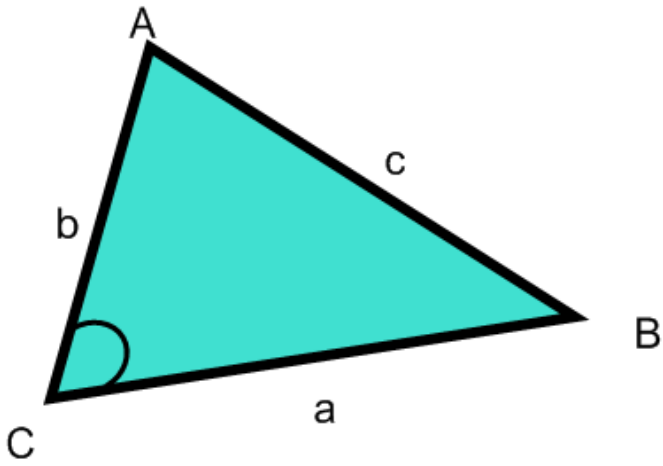


Find the size of the angle, θ , in the figure on the right, correct to the nearest degree.



From a point, P, a ship (S) is sighted 12.4 km from P on a bearing of 137° .
A point, Q, is due south of P and is a distance of 31.2 km from the ship.
Calculate the bearing of the ship from Q, correct to the nearest degree.

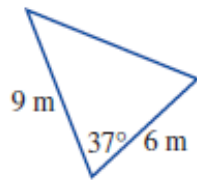
AREA OF TRIANGLES



$$Area = \frac{1}{2} a.b.\sin C$$

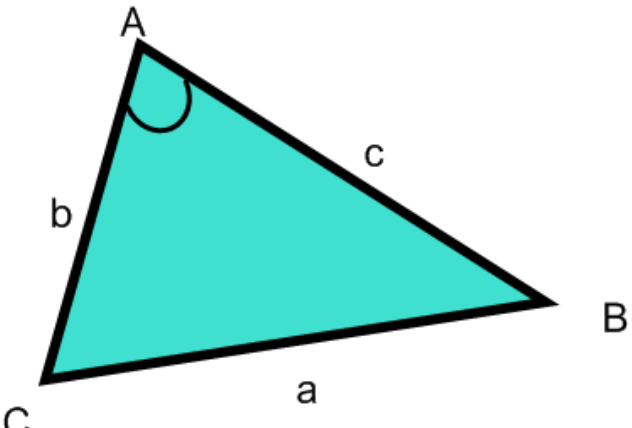
Must know two
sides and the
angle they
surround.

Find the area of the triangle at below (to 2 decimal places).

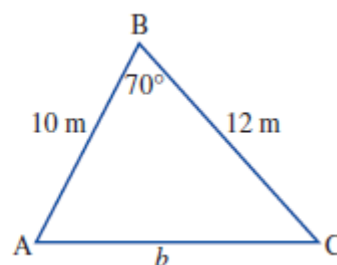


Two paths diverge at an angle of 72°. The paths' lengths are 45 m and 76 m respectively. Calculate the area between the two paths, correct to the nearest square metre.

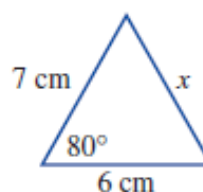
GOSINE RULE FOR SIDES

	<p>Remind you of anything?</p> $a^2 = b^2 + c^2 - 2bc \cdot \cos A$ <p>The formula should START and FINISH with the same letter.</p>
--	--

Find the length of the side marked b in the triangle on the right, correct to 1 decimal place.



Find the unknown length (to 2 decimal places), x , in the triangle at right.



A surveyor standing at a point, X, sights a point, M, 50 m away and a point, N, 80 m away. If the angle between the lines XM and XN is 45° , calculate the distance between the points M and N, correct to 1 decimal place.

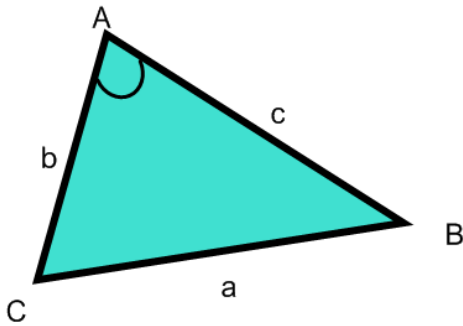


DRAW a picture...

GOSINE RULE FOR ANGLES



Can you rearrange the Cosine rule so the subject is the Cosine of the angle?



Begins and finishes with the same letter.

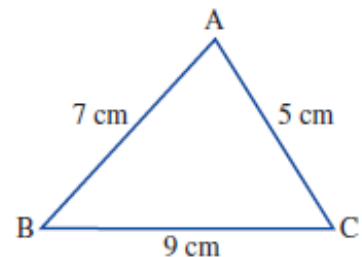
$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$

Need all three sides to use this formula.

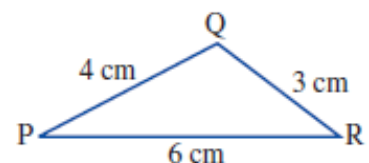
THE HINT

- The largest angle is always opposite the largest side.
- A negative ratio means an obtuse angle
- Worded problems always begin with a diagram and end with a statement.

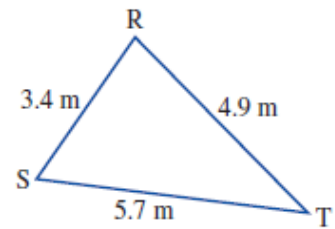
Find the size of angle B in the triangle on the right, correct to the nearest degree.



Find the size of angle Q in the triangle on the right, correct to the nearest degree.



Find the size of the largest angle in the triangle drawn on the right.



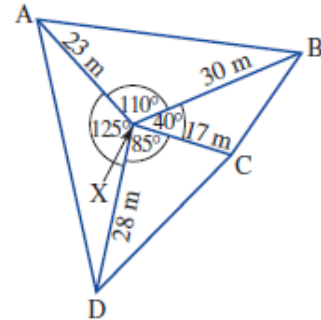
Two paths diverge from a point, A. The first path goes for 1.25 km to a point, B. The second path goes for 1.4 km to a point, C. B and C are exactly 2 km apart. Find the angle at which the two paths diverge.

RADIAL SURVEYS

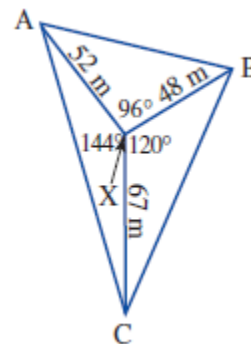
PLANE TABLE RADIAL SURVEY

This survey involves a series of arms that are drawn toward each corner of the field. The distance is then added to each arm.

The figure on the right is a plane table survey of a block of land. Calculate the perimeter of the block of land, correct to the nearest metre.



Calculate the area of the field on the right. Give your answer correct to the nearest square metre.

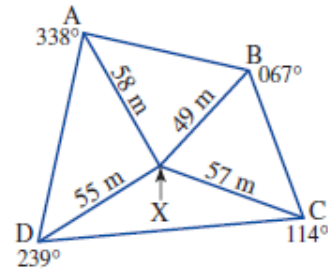


COMPASS RADIAL SURVEY

A Compass Radial Survey is different in that it has bearings given on each of the arms.

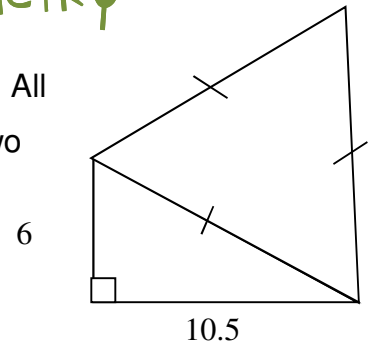
The figure on the right shows a compass radial survey of a block of land.

- a Calculate the size of $\angle AXB$.
- b Hence, calculate the distance AB, correct to the nearest metre.



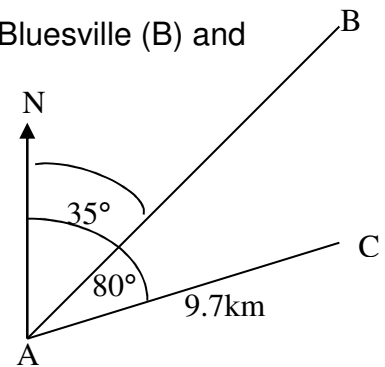
Mixed Examples of Trigonometry

1. Calculate the area of the equilateral triangle shown in the diagram. All dimensions are given in metres. Express your answer correct to two decimal places.



2. The diagram displays the relative positions of 3 towns, Axiom (A), Bluesville (B) and Chain (C). Calculate:

- The distance between Bluesville and Chain to one decimal place.
- The bearing, to the nearest minute, from Bluesville to Chain.



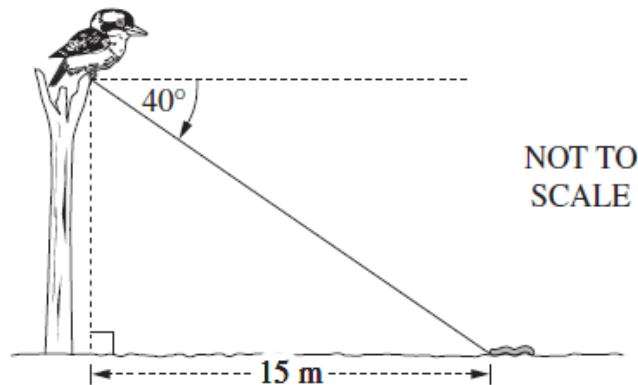
3. A ship leaves a port P and travels 25 km due north to reach a lighthouse, L. At L the ship turns onto a bearing of 290°T and travels a further 60 km to reach a marker buoy, B. At B the ship turns again and travels in a straight line back to P.
- Complete a neat sketch with all information attached.
 - Calculate the total distance travelled by the ship. Express your answer correct to one decimal place.
 - Calculate the area enclosed by the ship's path. Express the answer correct to one decimal place.
4. The lengths of the three sides of a triangle are 5 cm, 14 cm and 17cm. Calculate all three angles to the nearest minute.

5. The perimeter of a particular triangle is 60cm. Two of the sides are 15cm and 17 cm respectively. Calculate the size of the angle opposite the shortest side of this triangle
6. Two cars set off from the same point at midday. The first car travels at a constant speed of 65 kph on a bearing of 050°T while the second travels at a constant speed of 85 kph on a bearing of 265°T .
- Calculate the distance, to one decimal place, between the cars at exactly 2 pm that day.
 - Calculate the bearing that the second car would need to take to follow a straight line to the position of the first car. Express the answer correct to the nearest minute.

HSC QUESTIONS...

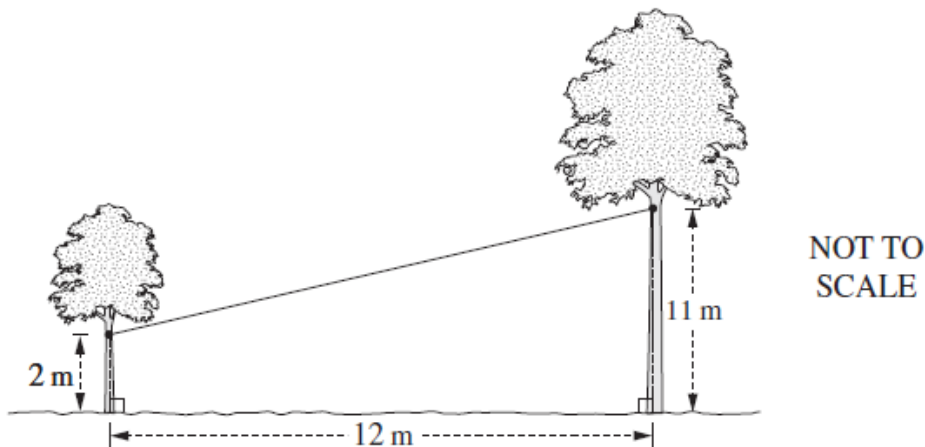
2011 HSC

- 4 The angle of depression from a kookaburra's feet to a worm on the ground is 40° . The worm is 15 metres from a point on the ground directly below the kookaburra's feet.



How high above the ground are the kookaburra's feet, correct to the nearest metre?

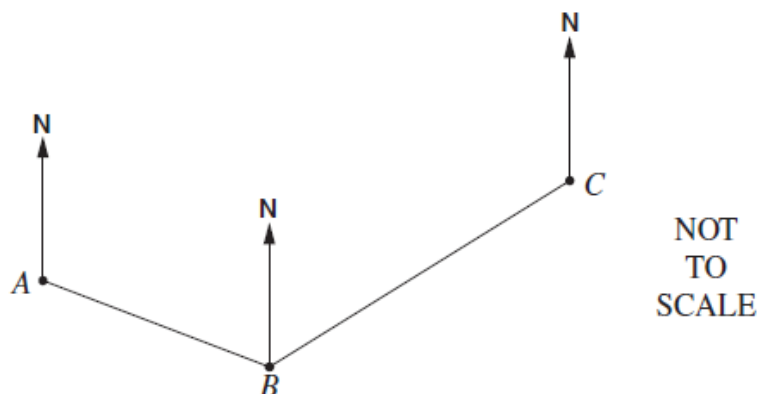
- (A) 10 m
(B) 11 m
(C) 13 m
(D) 18 m
- 9 Two trees on level ground, 12 metres apart, are joined by a cable. It is attached 2 metres above the ground to one tree and 11 metres above the ground to the other.



What is the length of the cable between the two trees, correct to the nearest metre?

- (A) 9 m
(B) 12 m
(C) 15 m
(D) 16 m

- (c) A ship sails 6 km from A to B on a bearing of 121° . It then sails 9 km to C . The size of angle ABC is 114° .

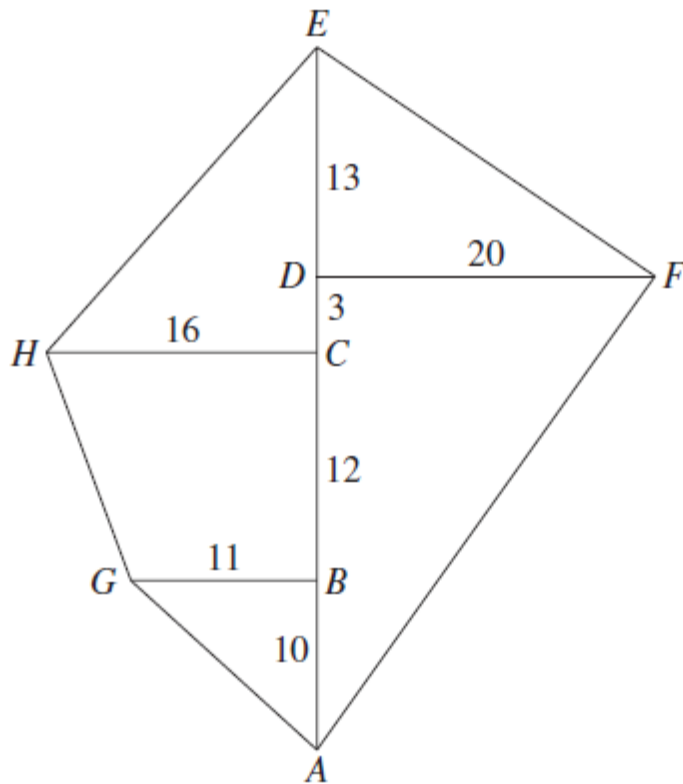


Copy the diagram into your writing booklet and show all the information on it.

- | | |
|---|---|
| (i) What is the bearing of C from B ? | 1 |
| (ii) Find the distance AC . Give your answer correct to the nearest kilometre. | 2 |
| (iii) What is the bearing of A from C ? Give your answer correct to the nearest degree. | 3 |

2010 HSC

- 3 A field diagram has been drawn from an offset survey.



NOT TO
SCALE

All measurements
are in metres.

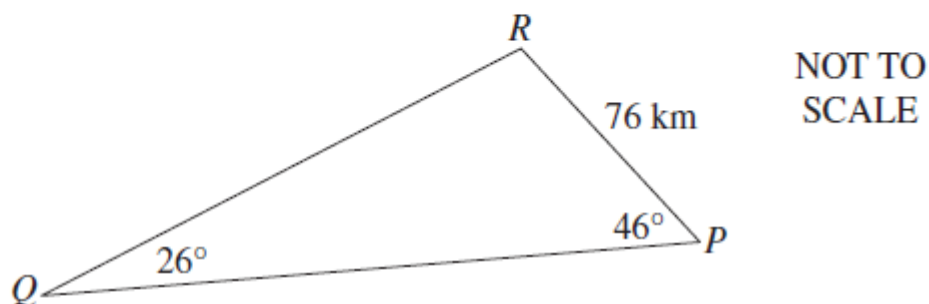
$AB = 10$ m
 $BC = 12$ m
 $CD = 3$ m
 $DE = 13$ m

What is the distance from G to H , correct to the nearest metre?

- (A) 11
- (B) 13
- (C) 16
- (D) 20

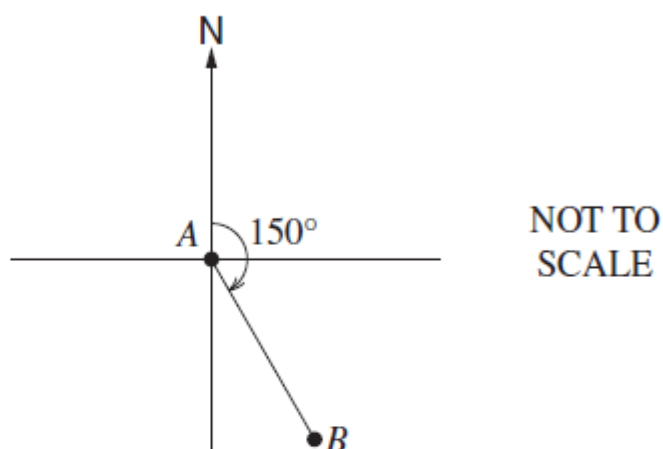
- 9 Three towns P , Q and R are marked on the diagram.

The distance from R to P is 76 km. $\angle RQP = 26^\circ$ and $\angle RPQ = 46^\circ$.



What is the distance from P to Q to the nearest kilometre?

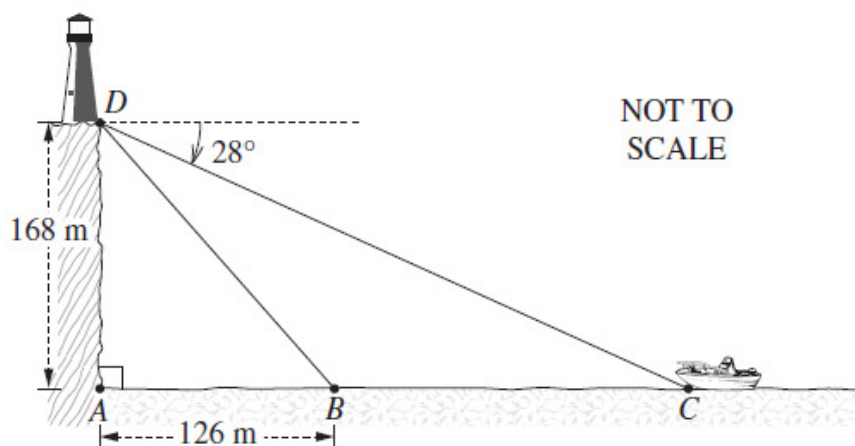
- (A) 100 km
 - (B) 125 km
 - (C) 165 km
 - (D) 182 km
- 10 A plane flies on a bearing of 150° from A to B .



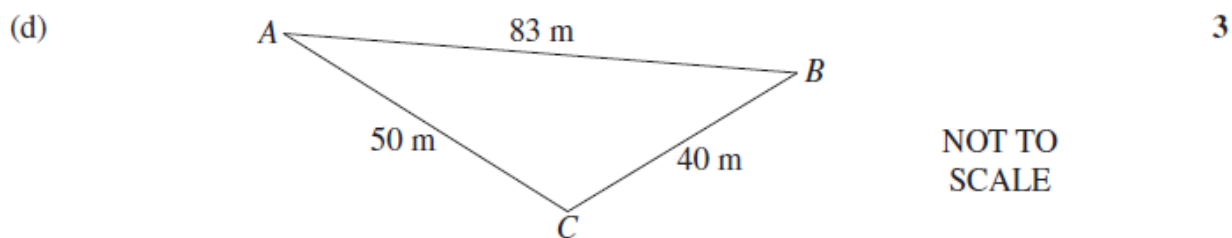
What is the bearing of A from B ?

- (A) 30°
- (B) 150°
- (C) 210°
- (D) 330°

- (d) The base of a lighthouse, D , is at the top of a cliff 168 metres above sea level. The angle of depression from D to a boat at C is 28° . The boat heads towards the base of the cliff, A , and stops at B . The distance AB is 126 metres.



- (i) What is the angle of depression from D to B , correct to the nearest minute? 3
- (ii) How far did the boat travel from C to B , correct to the nearest metre? 2



Find the area of triangle ABC , correct to the nearest square metre.